

Is ITS a horse race or a harbinger of an electronic apocalypse? The reality of ITS today is that it is closer to the winner's circle than the glue factory, but it is critical for the motor carrier industry to pay close attention to the field, place its bets carefully, and keep an eye on the successful thoroughbreds in the race.

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Intelligent Transportation Systems for Motor Carriers:

The Winner's Circle or the Four Horsemen of the Apocalypse?

Lance R. Grenzeback
Cambridge Systematics, Inc.

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The race to apply intelligent transportation systems (ITS) to motor carrier operations is on, and the motor carrier industry is watching the oncoming horses with anxiety. Some carriers see a horse race and hear the hoof-beat of winners promising big payoffs to the industry and are placing their bets. Many other carriers think they see the Four Horsemen of the Apocalypse spreading weight-distance taxes and carrying "big brother" into their trucks and offices. This article offers a guide to handicapping ITS. It looks at the future of the race; and the facts and myths about ITS. Who is likely to win, place, and show today; and the possible pay-offs and risks for motor carriers tomorrow.

The development of intelligent transportation systems for commercial vehicle operations (CVO) has been underway for about a decade. Intelligent transportation systems apply electronics, communications, and

information management technologies to transportation operations. The systems being developed for commercial vehicle operations are for operational activities and government regulation, and range from satellite-based vehicle location systems to roadside weigh-in-motion devices. These systems promise increased productivity, improved truck safety, and streamlined motor carrier regulation.

Today, there are nearly 200 private sector companies marketing ITS products and services to motor carriers, and over 50 publicly funded ITS CVO programs. Not all these efforts have enjoyed equal success in the race for acceptance and markets. There have been some good starts and more than few bad stumbles. The early results have left many motor carriers wondering about the future of the race -how they should bet, or if they should go to the race at all.

The Race

Intelligent transportation systems for commercial vehicle operations are here to stay. ITS for CVO are part of a broad revolution in business and logistics practices. Computers and communications technologies have given businesses the ability to coordinate widely separated manufacturers, distributors, and retailers. Deregulation and cost-saving innovations, such as intermodal containers, have made it possible for business to buy more transportation and reach lower cost labor markets and materials. The result has been a movement toward the outsourcing of manufacturing and assembly work, and the development of long supply chains and distribution networks. Coupled with this has been a push by businesses toward just-in-time manufacturing and retailing as a strategy to reduce inventory carrying costs.

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The product of these changes has been intense pressure on motor carriers to manage very price- and time-sensitive freight movements tailored to the needs of different shippers and receivers. Over the next decade motor carriers will be pushed and pulled into using ITS to meet their clients demands for more timely and predictable transportation services.

Motor carriers who learn how to use ITS will have a major competitive advantage within the industry. The prices of the computers, electronic sensors, software and communications services that underpin ITS are dropping. This will put ITS within reach of most motor carriers, but the advantage will go to those who have the perseverance to learn and understand the new technologies and the management skills to apply them. The biggest winners will be those who can anticipate how ITS will change the way they do business. Carriers can glimpse some of the possibilities in today's results.

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In the Win Column: ITS for Fleet Management

In the win column today are ITS fleet and vehicle management technologies: mobile

communications, automatic vehicle location, routing and dispatching software, and trip recorders. These are being developed and marketed primarily by the private sector. They are aimed at improving the productivity of motor carriers through better utilization of fleets and vehicles. The most frequent applications are for planning the next load, tracking the current load, optimizing cross-dock operations, managing fuel consumption, and analyzing driving habits.

The early payoffs from ITS fleet and vehicle technology have gone to long-haul truckload carriers, closely followed by time-sensitive couriers and parcel carriers. More recently, private fleets and urban pick-up-and-delivery operations have adapted ITS technologies to their operations. Most carriers have seen their initial investments — typically on the order to \$2000 to \$5000 per truck — paid back within two to three years. This is an attractive investment in a period of low margins and strong cost competition.

The hurdles to motor carriers looking to invest in these ITS technologies will soon drop a notch or two as manufacturers of ITS fleet and vehicle management technologies move toward common information system architecture standards. Many of today's systems use proprietary database software or incompatible data formats. Consequently, many ITS and business systems cannot talk to each other, forcing carriers to laboriously reenter or translate data from one system to the next. Common standards will permit data to be transferred directly, as is done in office word-processing and spreadsheet applications. For example, data on a truck's location may be linked directly from an satellite-based vehicle location system to a computerized route planning and dispatching program. As this happens, carriers will be able to knit ITS systems together with less risk and a quicker return on their investment.

Carriers handicapping ITS fleet and vehicle management systems also should anticipate pressure from shippers and receivers to build information systems and EDI (electronic data interchange) standards that will enable them to track intermodal shipments door-to-door regardless of mode. Truck, rail, and air carriers can track shipments within their systems, but shippers and receivers often lose track of shipments when they are transferred between modes. The barriers are institutional, not technical, and shippers and receivers will push hard for this capability. Carriers who can build or access this capability will gain and retain customers in the growing intermodal markets.

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sensors and computers to monitor driver fatigue and evaluate fitness-for-duty reach the market. This equipment will save lives, and motor carriers will be pushed hard to wire up for safety. But in an industry that reportedly is struggling to recruit qualified drivers today, will carriers be able to offset the additional loss of privacy with higher wages and safety bonuses tomorrow?

On the white horse, the motor carrier industry sees government-mandated ITS technologies. The industry is not certain what form these mandates will take — perhaps a crash-avoidance device, or a hazardous materials monitoring sensor, or a roll-over warning system — but they are convinced that the technologies will be expensive, difficult to maintain, and provide few if any benefits to a carrier's bottom line. Motor carriers repeatedly point to the government's premature advocacy of anti-lock brake systems as a good example of how not to introduce new technology to the industry. Many are convinced that, as ITS technologies proliferate, the government will not be able to resist calls to mandate a few gadgets.

But the industry may be re-fighting the battles of the past generation, before deregulation. Today, the push for new technologies is coming from the carriers, not the government. In many respects, carriers and truck manufacturers are ahead of the government in adopting ITS technology.

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The Finish Line

In the first running of ITS for CVO, fleet management systems are in the "win" category, roadside applications are a strong place, and desk-side applications are in the show

category. In the marketplace, though, the race is not so much among ITS CVO services as among individual motor carriers. For those who are jockeying for position in this race, a few key themes must be kept in mind

- **Keep Your Eyes on the Prize.** ITS for CVO arms to increase the productivity, safety, and competitiveness of the motor carrier industry. Its benefits are available to all carriers, but the purse will be greatest for those carriers who most effectively choose among the wealth of ITS CVO systems.
- **Take Off Your Blinders.** ITS for CVO is driving motor carriers and government toward a fundamental rethinking of the business of motor carrier operations and regulation. ITS is most effective when it facilitates carriers and government agencies to change the way they do business and interact with one another. The success of fleet management systems, in large part, stems from the ability of carriers to rethink how they work with clients, drivers, and maintenance staff. Similarly, roadside and desk-side ITS applications will pay off to carriers to the extent that the technologies enable carriers to change the way the industry does business with state regulatory agencies.
- **Watch the Winner's Circle.** Fleet management will continue to offer the best near-term opportunities for motor carriers, but look for roadside clearance and desk-side administration applications to come on strong over the next several years. The triple crown will go to carriers that are creative in putting ITS technology to work in all three areas.

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Mr. Grenzeback is Senior Vice President of Cambridge Systematics, Inc., of Cambridge Massachusetts. Contributing authors were Carol G. Colman, Senior Associate, and John G. Kaliski, Associate.

A bit further off, but with the potential for good operational payoffs, are smart maintenance systems. After 1995, almost all medium- and heavy-duty engines will be manufactured with their own built-in electronic communications network utilizing the SAE standard J1939 communications bus. Carriers will be able to plug trip recorders into their trucks and monitor a full array of engine and vehicle conditions without retrofitting the truck. As this capability grows, look for smart maintenance systems and software to help carriers diagnose maintenance data and identify areas for savings.

Following closely behind will be driver safety systems. These systems will use on-board sensors and smart diagnostic software to monitor driver fatigue and fitness for duty. Accidents impose huge personal and corporate costs on drivers, motor carriers, shippers, insurers, and the public. Driver fatigue and driver error are contributing factors in some truck accidents. ITS systems to monitor driver fatigue and performance are still in the research and development stage, but competitive carriers should watch these yearlings closely. Good safety performance on a carrier's part will save lives, save money, and attract clients.

In the Place Column: ITS for Roadside Enforcement

In the place column are ITS roadside technologies being deployed by the public sector: automatic vehicle identification (AVI) and weigh-in-motion (WIM) systems. These technologies are reducing en route delays to motor carriers by automating weigh station checks and toll collection. Carriers save time because they do not stop and queue to be weighed or pay tolls; they are weighed and identified at highway speeds as they pass by a weigh station or toll barrier. Roadside clearance systems are just now moving from demonstration to widespread deployment, and there is considerable room for growth and improvement.

The early payoffs have gone to carriers operating just-in-time delivery systems, long-haul carriers, contract drivers paid by the hour, and carriers who repeatedly pass the same weigh station or toll barrier. The benefit-to-cost ratio for transponder-equipped carriers is estimated to be about 10-to-1 at the current cost of an automatic vehicle identification transponder—now between \$50 and \$75.

Carriers with less demanding schedules, and carriers operating in areas with few and non-

congested weigh stations and toll roads have found these ITS applications convenient but not compelling, so carriers must look at this investment on a fleet-by-fleet basis. However, the payoff for the motor carrier industry as a whole could be substantial because the average state weighs more than 3.1 million trucks a year.

Handicappers should look for the states to increase the pace of their investment in ITS roadside clearance systems. The benefit-to-cost ratio for automating weigh stations today is modest — about 1.5-to-1 — but the investment enables inspectors to keep pace with increasing truck volumes even while enforcement staff budgets are being cut. The return on investment comes from the ability to identify and cite carriers that have not paid registration and fuel taxes. By removing transponder-equipped trucks from weigh station queues, the state gains the capacity to screen trucks that are now waved off without a weighing or credentials check at congested stations. At toll barriers, the return to the state comes from reduced capital and operating costs. An express electronic toll collection lane can handle five times as many vehicles as a manually operated lane; this reduces the need to add additional lanes and operators as traffic grows.

The major obstacle that threatens to dismount both the carriers and the states riding these technologies is the lack of AVI standards (or more generally, vehicle-to-roadside communication [VRC] standards). Transponders are on their way to becoming as prevalent as bingo stamps once were: a red transponder for the West Coast, a blue one for the East Coast, a green one for this toll bridge, a yellow one for that toll road. The motor carrier industry has been adamant about the need for standardized transponders. Progress is being made, but it is coming at a walk, not a gallop. As transponders are standardized, look for the emergence of multiple-purpose transponders that can be used to pay tolls, bypass weigh stations, verify fuel purchases, receive traffic congestion information, or access maintenance records from smartcards. This will increase the payout for carriers dramatically.

While the crowd has its eye on the battle of the transponders, look for toll authorities and state police agencies to start betting on video/machine vision systems. States are under public pressure to show that they are enforcing motor carrier regulations and targeting high-risk carriers. Computerized video systems are capable of reading a license plate or U.S. DOT number from a

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On the pale horse, some see a national weight-distance tax. Many in the trucking industry look at the weigh-in-motion (WIM), automatic vehicle identification (AVI), and computer technologies being assembled under ITS programs for automated weigh station clearance, and see the tools that make a national weight-distance tax possible. And behind a national weight-distance tax, the industry imagines its version of Hades: increasing paperwork; lower taxes for short-haul intrastate carriers at the expense of the more visible long-haul interstate carriers; and an electronically streamlined third-tier tax that adds to, rather than replaces, existing registration and fuel taxes. Carriers point to the proactive roles taken by weight-distance tax states in ITS programs — such as Kentucky in the Advantage I-75 Program — as proof of the link between ITS and weight-distance taxes.

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However, the evidence that ITS is pushing states toward a national weight-distance tax program is not strong yet. Oregon and Kentucky, for example, established their weight-distance tax programs well before the onset of ITS and, in recent years, the number of states administering weight-distance taxes has decreased rather than increased. In general, state revenue administrators remain skeptical about the return on investment from a weight-distance tax. The implementation and enforcement of a weight-distance tax — even with efficient ITS technology — are perceived to be expensive, and the target relatively small. Truck registration fees and fuel taxes are an important source of revenue for the states, but are modest compared to the revenues derived from passenger vehicle registrations, sales taxes, and income taxes.

However, the possibility of a weight-distance tax remains. ITS has moved states and carriers closer to a weight-distance tax program for overweight containers and longer-combination vehicle (LCV) operations (i.e., double nailers or triple trailers). Several states are experimenting with AVI as a means of permitting and tracking overweight containers and LCV moves on a pay-as-you-go basis. Could these experiments mature into a full-blown weight-distance tax program for conventional truck operations? Possibly, but to date these efforts have been limited to a small handful of states, routes, and carriers.

On the red horse, ITS skeptics see a looming threat to the confidentiality of motor carrier business information. An increasing propor-

tion of motor carrier transactions — waybills, routing instructions, and invoices — are moved by electronic data interchange, and all are subject to electronic eavesdropping. Trucks equipped with satellite-based vehicle location systems can be tracked across the country. And the public and private sectors now are building a network of AVI readers across the country — at weigh stations for automated clearance; at toll barriers for automated toll collection; at fuel stops for credit checks; and at terminals and intermodal yards for management of tractors, containers, and chassis. And within a decade, it may be possible — at least technically — to track an AVI-equipped truck across the country.

Some carriers are concerned that the government will tap this information to enforce taxes and pry into business practices. Of even greater concern is the possibility that competitors will gain access — legally or illegally — to confidential business and fleet information, and will use this to steal clients and markets. The industry met this problem head on in the HELP Program. To protect their interests, carriers and states were given equal representation on the program's board of directors, and operation of the automated weigh-station clearance system and its database on truck movements was contracted to a third-party, private sector firm with clear rules on who gets what data. So far, the arrangement has worked well, but the need to protect confidential business information will grow as businesses and the motor carrier industry automate and apply ITS technologies more broadly.

On the black horse, truck drivers see loss of privacy in their workplace. Owner-operators have been particularly outspoken about the threat of ITS technology as big brother, but it is company drivers, some argue, that are most exposed today — to trip recorders that monitor continuously the performance of the driver and vehicle: to automatic vehicle location systems that track their route mile-by-mile; and to on-board computers that record hours of service, fuel purchases, pick-up-and-delivery activity, and, eventually, alertness.

Truck driver assessment of ITS technology has been mixed. Some resent what they perceive as a loss of independence and the increasing regimentation of their workplace, but they value the increase in productivity and income that can be gained through ITS technology. The real test for the motor carrier industry will come over the next decade as

moving truck as it approaches a toll barrier or weigh station and checking the number against a regional or national database. These systems can be used to debit a toll against a charge account, identify a scofflaw, or target a high-risk carrier for inspection. ITS video systems will help level the playing field for legal and safe carriers as well as provide an alternative for carriers who do not want to wear a tag, but also will require that carriers be vigilant about the accuracy of information on their accounts and safety performance.

The biggest payoffs to the motor carrier industry in this area will come from pairing the capabilities of ITS fleet management systems and roadside clearance systems. Within a decade, fleet management technology — on-board monitors and communications systems — will give carriers the ability to monitor the real-time, on-the-road safety performance of their drivers and vehicles. Carriers have not had this capability to date, and have relied primarily on state motor carrier enforcement programs to enforce safe driving practices. Carriers that can monitor and verify their real-time safety performance through ITS technology will be able to push the states to eliminate all but occasional random roadside safety checks of their trucks. Smart carriers will realize safety benefits, minimize a source of en route delays, and leave their competitors in the slow lane at the inspection station.

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In the Show Column: ITS for Credential and Tax Administration

In the show column are one-stop shopping credential and tax administration systems. Most of these ITS systems are still in development, but will be built around electronic data interchange standards, wide-area data communication networks, and distributed databases. Their objective is to automate and streamline desk-side administrative procedures for registration, permitting, and tax reporting.

The scope of the early projects has been limited: 800-numbers to give carriers a single point of contact for motor carrier issues; an Internet world-wide-web home page to give carriers access to current regulations and answers to frequently asked questions; and prototype software for carriers to use to register their trucks electronically. The next generation of entrants will tackle more complex transactions, such as fuel tax payments and oversize/overweight permitting.

For motor carriers, as well as for states, these applications promise to reduce the time, cost, and hassle associated with transacting business between motor carriers and state agencies. Expectations for these systems are high because similar EDI- and electronic funds transfer (EFT)-based systems have been developed in the private sector with positive long-term payoffs. But the institutional hurdles to the development of these services in the public sector are high; they require reengineering of procedures across large entrenched bureaucracies, as well as investment in computer and communications systems at a time when state and federal budgets are being cut. Without motor carrier support, these changes and any benefits to the motor carrier industry will be slow out of the gate.

A decade from now, states could have deployed enough roadside technology to build reliable statistical profiles of truck volumes and weights by route, highway system, and state. This would provide states with the information they need to apportion registration and fuel taxes among routes, systems, and states. Once that capability exists, the motor carrier industry can push for legislation to do away with mileage reporting by state.

The payoff for motor carriers would be a sharp reduction in the costs associated with record keeping, tax filing, and audits. Every interstate carrier would realize benefits. The states also would get a payoff from simplifying the administration of interstate registration and fuel tax programs. By shifting state resources from audits to traffic counts, states would gain better information for their big ticket item — the design and maintenance of bridges and pavements.

The Four Horsemen of the Apocalypse

But some suggest that the ITS horse race does not conclude with winner's circle roses, but with crippled competitiveness. The Four Horsemen of the Biblical prophecy come to mind — riding the pale, red, white and black horses — representing the scourges which come to mankind at the end of the world. Equivalent blights for the trucking industry might include a national weight-distance tax, loss of corporate intelligence, the invasion of driver privacy and government-mandated technologies. These are very real concerns for motor carriers, but whether ITS will bring these blights remains to be seen.